

A REVIEW OF THE GENUS *REMENUS* RICKER  
(PLECOPTERA: PERLODIDAE), WITH THE DESCRIPTION OF  
TWO NEW SPECIES

BORIS C. KONDRATIEFF AND CHARLES H. NELSON

(BCK) Department of Entomology, Colorado State University, Fort Collins, Colorado 80523; (CHN) Department of Biological and Environmental Sciences, 615 McCallie Avenue, The University of Tennessee, Chattanooga, Tennessee 37403.

---

*Abstract.*—The formerly monotypic Nearctic genus *Remenus* is revised to include three species: *R. bilobatus* (Needham and Claassen), Appalachian in distribution; *R. kirchneri* n. sp., from Virginia; *R. duffieldi* n. sp., from Georgia. The male and female are described for each species, and the descriptions are supported by illustrations and SEM photomicrographs.

*Key Words:* Plecoptera, stoneflies, Perlodidae, *Remenus*, Nearctic

---

Since Ricker's (1952) classic review of the Perlodinae, the Nearctic genus *Remenus* has been considered monotypic. Stark and Szczytko (1984) assigned *Remenus* to the Diploperlini based on typical turtle-shaped eggs and the male seventh sternum which is produced into a distinct lobe. The only species, *R. bilobatus* (Needham and Claassen), has been reported along the Appalachians from Connecticut to South Carolina and Georgia (Stark, Szczytko and Baumann 1986). During the preparation of a chapter on the Perlodinae of Eastern North America for an upcoming publication, it became apparent that more than one form was involved.

Morphology and terminology follow Stark and Szczytko (1984). Abbreviations for depositories of specimens are: Cornell University Insect Collection, Ithaca, New York (CUIC); C. P. Gillette Museum of Arthropod Diversity, Colorado State University (CSU); National Museum of Natural History (USNM); Charles H. Nelson Collection (CHN); Bill P. Stark Collection, Mississippi College, Clinton (BPS); and Virginia

Polytechnic Institute and State University (VPI).

*Remenus bilobatus*  
(Needham and Claassen)  
Fig. 1-3, 8a, 8b, 11, 12

*Perla bilobata* Needham and Claassen, 1925: 95. Holotype male: New York: Old Forge, 7-19 July 1905 (CUIC, #1153), examined.

*Description.*—*Male:* Length of forewing 8-9 mm; length of body 7-9 mm. General body color in alcohol light brown (pale yellow-brown in life). Head and pronotum with light brown pattern (Fig. 1). Wings hyaline; veins light brown.

*Male genitalia:* Tenth tergum weakly cleft for  $\frac{1}{3}$  of its length; hemitergal lobes short, clothed with short setae and sensilla basiconia (Fig. 3). Ninth tergum with short setae and sensilla basiconia (Fig. 3). Paraprocts reduced. Lateral stylets absent. Epiproct covered basally with dense yellow spinulae, enclosed by a golden setae-lined pocket, terminating in a threadlike lash (Figs. 2, 3).

*Female*: Length of forewing 10–11 mm; length of body 9–10 mm. General color and external morphology similar to the male. Subgenital plate broadly rounded to more narrowly rounded, produced  $\frac{2}{3}$  the length of the 9th sternum, with basal lateral crease (Figs. 8a, 8b).

*Egg*: Turtle shaped. Chorion relatively smooth with keel extending from lid to posterior  $\frac{2}{3}$ ; lid with irregular follicle cell impressions (Figs. 11, 12).

*Diagnosis*.—Males of *R. bilobatus* are easily distinguished from both *R. kirchneri* n. sp. and *R. duffieldi* n. sp. by the threadlike lash of the epiproct apex (Figs. 2, 3). The length of the lash varies, reaching to the seventh or eighth tergum when fully extended. Most preserved specimens have only a short length of the lash exposed as figured by Hitchcock (1974, Fig. 309) or partially extended as illustrated by Kondratieff and Voshell (1982, Figs. 26–27). Additionally, the fragile terminal lash is occasionally broken and missing from the golden setae-covered basal portion of the epiproct in preserved specimens. Females can usually be distinguished by the large subgenital plate with an incomplete basal transverse crease (Fig. 8a, 8b).

*Remarks*.—Needham and Claassen (1925) originally described *Perla bilobata* from "many specimens" from Old Forge, New York and Black Mountain, North Carolina. The Black Mountain specimens are typical *R. bilobatus*. Apparently this small perlodine ranges from New England to Alabama and Tennessee along the Appalachians and into the Piedmont Plateau Physiographic province. *Remenus bilobatus* occurs in small to medium-sized cool streams. Adults are active from May to July, but never commonly collected.

*Material examined*.—ALABAMA: Cleburne Co., small stream above lake, Cheaha State Park, 14 May 1988, B. Kondratieff and R. F. Kirchner, 3 males, 3 females (CSU). CONNECTICUT: Tolland Co. Storrs, 18 June 1954, J. A. Slater, 1 male,

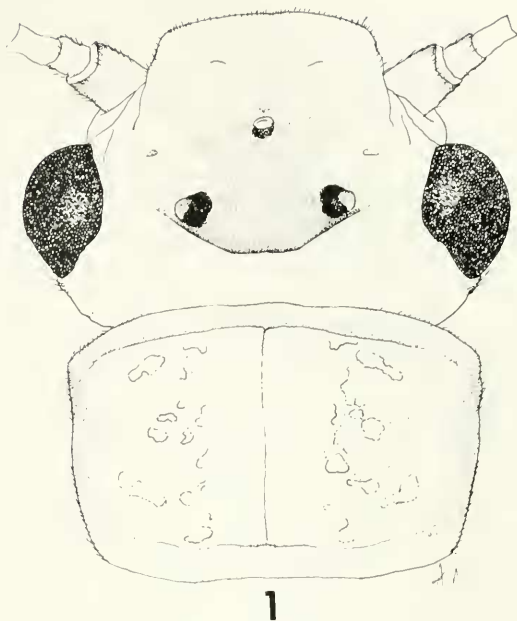
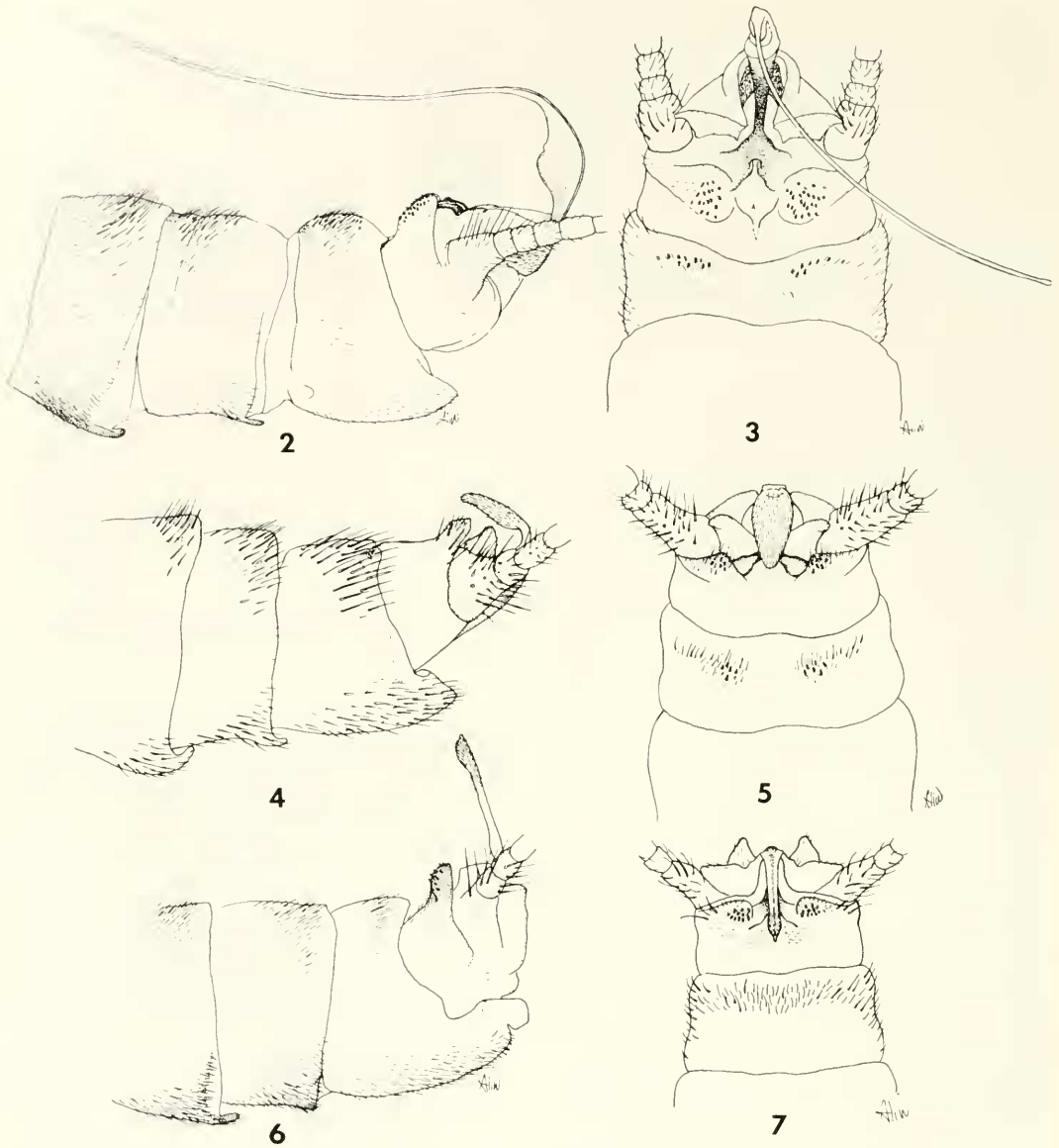


Fig. 1. *Remenus bilobatus*, head and pronotum.

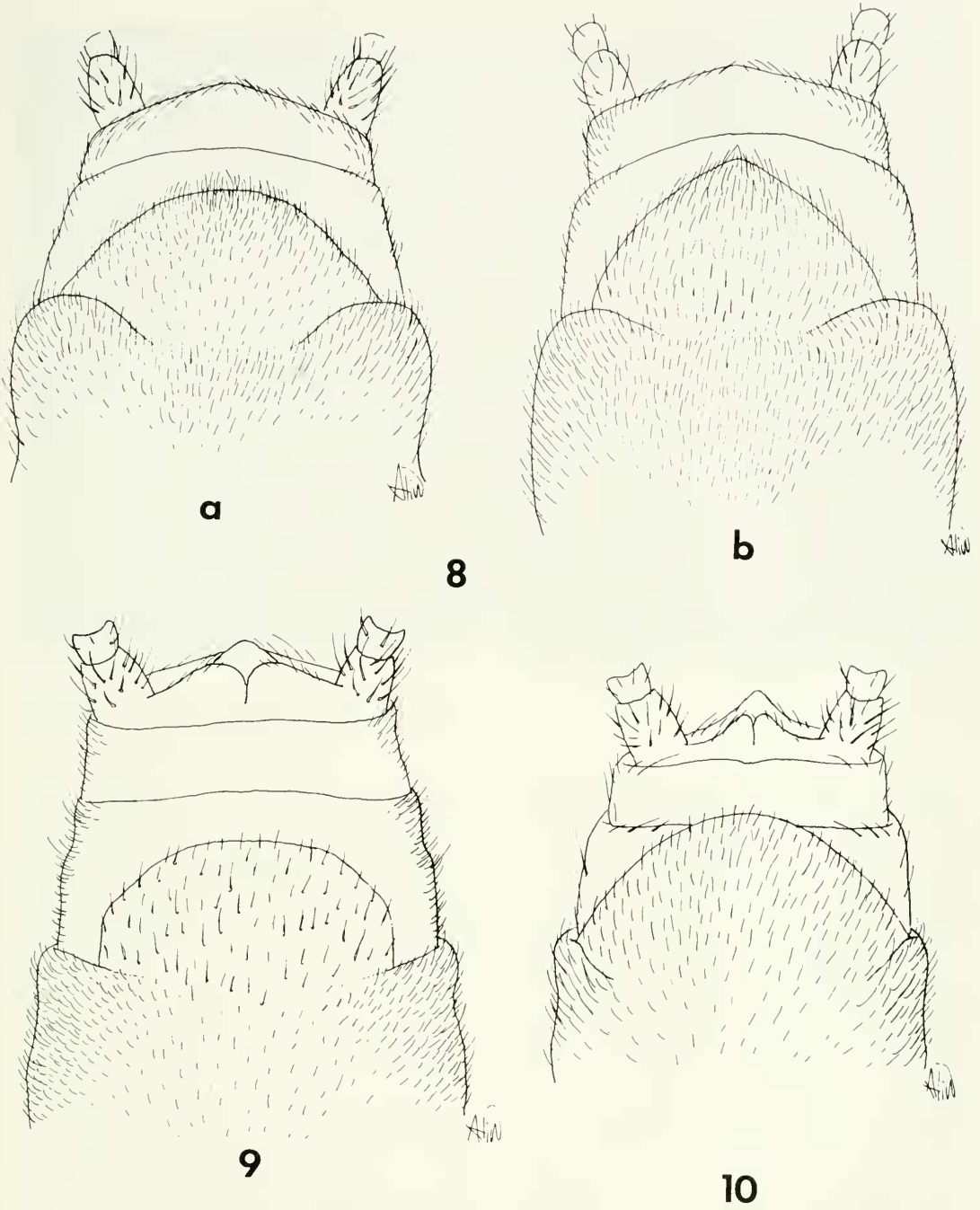
1 female (USNM); brooklet crossing Rt. 48, Killingworth, 18 June 1965, S. W. Hitchcock, 4 males (USNM); Madison, near Rt. 80, 18 June 1965, S. W. Hitchcock, 1 male (USNM). MARYLAND: Fredrick Co., Big Hunting Creek, Thurmont, 4 June 1987, R. M. Duffield, 1 male (CHN); same but 22 June 1988, 1 female (CHN). NORTH CAROLINA: Black Mountain, July–Aug. 1912, Beutenmuller, 2 males (previously cleared), 1 female (CUIC, Paratypes #1153); Haywood Co., Sterling Creek, Rt. 23 (Rd 1397), GSMNP, 10 July 1983, B. Kondratieff and R. F. Kirchner, 2 females (VPI); Macon Co., Jarrett Creek, Arrowwood Glade, Nantahala National Forest, 25 May 1993, B. Kondratieff and R. F. Kirchner, 1 male (CSU); Transylvania Co., South Fork of Mills River, FR 1206 off Rt. 276, 8 July 1981, B. Kondratieff and R. F. Kirchner, 2 males, 3 females (VPI). PENNSYLVANIA: Adams Co., near Fairfield, 18 June 1950, D. G. Shappiro, 2 males (USNM). SOUTH CAROLINA: Oconee Co., Townes Creek, Road 710, Sumter National Forest, 24 May 1993,



Figs. 2-7. *Remenus*, male terminalia. 2. *R. bilobatus*, lateral (epiproct fully extended). 3. *R. bilobatus*, dorsal. 4. *R. kirchneri*, lateral. 5. *R. kirchneri*, dorsal. 6. *R. duffieldi*, lateral. 7. *R. duffieldi*, dorsal.

Kondratieff and Kirchner, 1 female (CSU); Pickens Co., Wildcat Creek, 9 km NW Clemson, 24 May 1981, B. P. Stark et al., 6 males (BPS); TENNESSEE: Polk Co., GoForth Creek, Rt 64, Cherokee National Forest, 3 June 1993, C. H. Nelson, 1 male (CHN); VIRGINIA: Bland Co., Wolf Creek, Rt. 61, 10 June 1978, B. Kondratieff, 1 male

(VPI); Montgomery Co., Toms Creek, Rt. 655, 29 May 1978, B. Kondratieff, 1 male (reared) (VPI); small spring flowing into Craigs Creek, 2.7 km off Rt. 460 on Rt. 621, 17 June 1980, B. Kondratieff, 1 male (VPI); Tazewell Co., East Fork Cove Creek, Rt. 662, 12 June 1983, B. Kondratieff and R. F. Kirchner, 1 male (VPI).



Figs. 8-10. *Remenus*, female subgenital plate. 8a. *R. bilobatus*, Maryland. 8b. *R. bilobatus*, South Carolina. 9. *R. kirchneri*. 10. *R. duffieldi*.



*Remenus kirchneri* Kondratieff and Nelson,  
NEW SPECIES  
Figs. 4, 5, 9

Description.—*Male*: Length of forewing 8–9 mm; length of body 8–9 mm. General body color in alcohol light brown (pale green-brown in life). Head and pronotum with light brown pattern similar to Fig. 1. Wings hyaline; veins light brown.

*Male genitalia*: Hemitergal lobes short, clothed with short setae and few sensilla basiconia (Fig. 5). Ninth tergum with long setae and few scattered sensilla basiconia (Fig. 5). Paraprocts reduced. Lateral stylets absent. Epiproct in dorsal view, pear-shaped (Fig. 5), covered with fine appressed spinulae; in lateral view, subparallel, slightly constricted at apex (Fig. 4).

*Female*: Length of forewing 10–11 mm; length of body 9–10 mm. General color and external morphology similar to the male. Subgenital plate broadly rounded, produced  $\frac{2}{3}$  length of 9th sternum, with basolateral margins parallel for at least  $\frac{1}{2}$  of plate length (Fig. 9).

*Egg*: Unknown.

Types.—HOLOTYPE male: Virginia, Patrick Co., Little Rock Castle Creek, Rock Castle Gorge National Recreation Area, 24 May 1990, B. Kondratieff and R. F. Kirchner. PARATYPES: Same as holotype, 1 male, 1 female; Floyd Co., spring-fed stream entering Little River, Rt. 686, 8 June 1978, B. Kondratieff, 1 male (VPI); small spring seep, Rt. 221, Roadside Park,  $\frac{1}{4}$  mile S of Floyd, 6 July 1980, B. Kondratieff, 2 males (CHN); small spring-fed stream, 6 miles E of Floyd, Rt. 221, 28 June 1981, B. Kondratieff, 1 male, 1 female (VPI); Patrick Co., spring-fed tribs. of Little Rock Castle Creek, Rt. 605, 10 May 1983, B. Kondratieff, 1 male (VPI); small spring-fed stream into Tallant Reservoir, Dan River, 2 August 1982, B. Kondratieff, 1 female (VPI).

The holotype will be deposited in the USNM. Paratypes will be deposited in CSU, CHN, and VPI collections.

Etymology.—The authors take great

pleasure in naming this species for our friend, Ralph F. Kirchner, Huntington, West Virginia, in recognition of his many contributions to the study of North American stoneflies.

Diagnosis.—Males of *R. kirchneri* are easily distinguished from *R. bilobatus* by the absence of a terminal epiproctal lash, and from *R. duffieldi* n. sp. by the pear-shaped epiproct (Fig. 5). The smaller subgenital plate with parallel basolateral margins (Fig. 9) distinguishes the females from the other two species.

Remarks.—This species is only known from small headwater spring-fed streams or seeps of the lower Blue Ridge physiographic province of Virginia. At the type locality, another apparently endemic stonefly species of this area, *Sweltsa voshelli* Kondratieff and Kirchner is found. Other common stoneflies at the type locality are *Peltoperla tarteri* Stark and Kondratieff and *Tallaperla maria* (Needham and Smith).

*Remenus duffieldi* Nelson and Kondratieff,  
NEW SPECIES

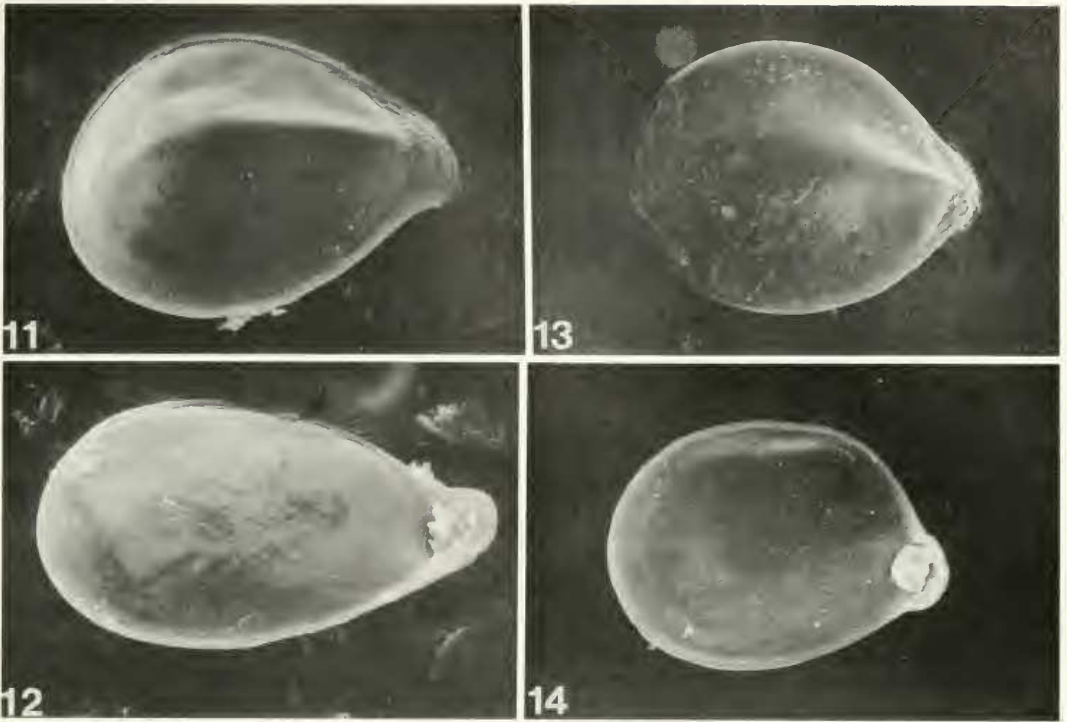
Figs. 6, 7, 10, 13, 14

Description.—*Male*: Length of forewing 8–9 mm; length of body 8–9 mm. General body color in alcohol light brown (pale green in life). Head and pronotum with light brown pattern similar to Fig. 1. Wings hyaline; veins light brown.

*Male genitalia*: Hemitergal lobes short, clothed with short setae and few sensilla basiconia (Fig. 7). Ninth tergum with long setae (Fig. 7). Paraprocts reduced. Lateral stylets absent. Epiproct elongate, slightly expanded apically (Figs. 6, 7) with long hair-like spinulae on apex, with dorsal sclerite long, narrow, reaching apex (Fig. 6).

*Female*: Length of forewing 10–11 mm; length of body 9–10 mm. General color and external morphology similar to male. Subgenital plate broadly rounded, produced to posterior margin of 9th sternum (Fig. 10).

*Egg*: Turtle-shaped. Chorion with weak follicle cell impressions and dorsal keel ex-



Figs. 11–14. *Remenus* eggs. 11. *R. bilobatus*, dorsal (203 $\times$ ). 12. *R. bilobatus*, ventral (230 $\times$ ). 13. *R. duffieldi*, dorsal (186 $\times$ ). 14. *R. duffieldi*, ventral (178 $\times$ ).

tending from lid to near middle; lid covered with irregular follicle cell impressions (Figs. 13, 14).

Types.—*HOLOTYPE* male: Georgia: Towns Co., Soapstone Creek, Rt 180 near junction Owl Creek Road, Chattahoochee National Forest, 8 June 1994, C. H., C. P., B. A. Nelson. *PARATYPES*: Same as holotype, 2 males (CHN); Union Co., Slaughter Creek, Rt. 180, Chattahoochee National Forest, 30 May 1994, C. H. Nelson, 1 female (CHN); Rock Creek, junction Rt 69, 1.5 miles W High Tower Gap, Chattahoochee National Forest, 29 May 1990, R. M. Duffield, 2 males (CHN); Soapstone Creek, Junction 180, Chattahoochee National Forest, 26 May 1990, R. M. Duffield, 1 male (CHN); White Co., Andrews Creek, Rt 17/75, Andrews Cove Campground, Chattahoochee National Forest, 8 June 1994, C. H. Nelson, 1 male, 3 females, 1 nymph (CHN).

The holotype will be deposited in the USNM. Paratypes will be deposited in CSU and CHN collections.

Etymology.—This species is named for Dr. Richard Duffield, Howard University, Washington, D.C. who first collected specimens of this interesting new species.

Diagnosis.—Males of *R. duffieldi* are easily distinguished from both *R. bilobatus* and *R. kirchneri* by the elongate almost club-like epiproct (Figs. 6, 7). Females of *R. duffieldi* can be separated from both *R. bilobatus* and *R. kirchneri* by the broadly rounded subgenital plate reaching the posterior margin of ninth sternum (Fig. 10).

Remarks.—The nymph of *R. duffieldi* is similar to the nymph of *R. bilobatus* as described and figured by Stewart and Stark (1988). Like *R. bilobatus*, *R. duffieldi* is found in small to mid-sized montane Appalachian streams. Other stonefly species collected with this new species were *Pteronarcys scotti*

Ricker, *Tallaperla cornelia* (Needham and Smith), *Acroneuria abnormis* (Newman), *Yugus bulbosus* (Frison), *Alloperla usa* Ricker, *Sweltsa lateralis* (Banks), *Amphinemura wui* (Claassen), *Leuctra biloba* Claassen, and *Leuctra alexanderi* Hanson.

With the inclusion of the two new species, *R. duffieldi* and *R. kirchneri*, adult males of the genus *Remenus* are defined by the following combination of characters: (1) tenth tergum cleft, 1/3 of its length producing short hemitergal lobes, (2) well-developed ventral lobes on sterna seven and eight and (3) eastern Nearctic in distribution. Females of the genus are difficult to distinguish from other Perlodidae, without associated males, especially *Isoperla*, but the combination of the dorsal head pattern, small size (body length 9–10 mm), and subgenital plate form are usually diagnostic.

KEY TO REMENUS SPECIES

- 1. Epiproct of male terminating in a threadlike lash (Figs. 2, 3); subgenital plate of female broadly to narrowly rounded, with basal transverse crease incomplete (Figs. 8a, 8b) ..... *R. bilobatus*
- Epiproct without terminal lash (Figs. 4, 5 and 6, 7); apex of subgenital plate broadly rounded, without basal crease (Figs. 9, 10) ..... 2
- 2. Epiproct in dorsal view, pear-shaped (Fig. 5); subgenital plate not reaching posterior margin of 9th sternum, with sides subparallel (Fig. 9) ..... *R. kirchneri*
- Epiproct, in dorsal view elongate, sides almost parallel (Fig. 7); subgenital plate, reaching posterior margin of 9th sternum, broadly rounded (Fig. 10) ..... *R. duffieldi*

ACKNOWLEDGMENTS

We thank E. Richard Hoebeke, Cornell University for the loan of type material of

*R. bilobatus*. We are also grateful to Oliver S. Flint, Jr., National Museum of Natural History, Washington, D.C.; Bill P. Stark, Mississippi College, Clinton, Mississippi; and J. Reese Voshell, Virginia Polytechnic Institute and State University, Blacksburg, Virginia for the loan of valuable material. Bill P. Stark, and Richard W. Baumann, Brigham Young University are thanked for reviewing the manuscript. Alison Anderson-Williams provided the illustrations. Dr. Robert E. Lee, Department of Anatomy and Neurobiology, Colorado State University, graciously provided the SEM photomicrographs.

LITERATURE CITED

Hitchcock, S. W. 1974. Guide to the insects of Connecticut. Part VII. The Plecoptera or stoneflies of Connecticut. Bulletin of the State Geological and Natural History Survey of Connecticut 107: 1–262.

Kondratieff, B. C. and J. R. Voshell, Jr. 1982. The Perlodinae of Virginia, USA (Plecoptera: Perlodidae). Proceedings of the Entomological Society Washington 84: 761–774.

Needham, J. G. and P. W. Claassen. 1925. A monograph of the Plecoptera or stoneflies of America North of Mexico. Thomas Say Foundation 2: 1–397.

Ricker, W. E. 1952. Systematic studies of Plecoptera. Indiana University Publications Science Series 18: 1–200.

Stewart, K. W. and B. P. Stark. 1988. Nymphs of North American Stonefly Genera (Plecoptera). Thomas Say Foundation, Entomological Society America 12. 460 pp.

Stark, B. P., S. W. Szczytko, and R. W. Baumann. 1986. North American stoneflies (Plecoptera): Systematics, distribution and taxonomic references. Great Basin Naturalist 46: 383–397.

Stark, B. P. and S. W. Szczytko. 1984. Egg morphology and classification of Perlodinae (Plecoptera: Perlodidae). Annales de Limnologie 20: 99–104.